NEW ANALYSES OF ANTARCTIC CARBONACEOUS CHONDRITES

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Abstract: New analyses have been made on the Antarctic carbonaceous chondrites ALHA77306 and ALHA77307. Only traces of amino acids have been detected in ALHA77307. Non-protein amino acids were not detected. Inorganic analyses using INAA techniques showed no significant differences between interior and exterior pieces of ALHA77306. ALHA77306 is a C2 chondrite and ALHA-77307 a C3V chondrite.

Among the most interesting meteorites found in Antarctica are the carbonaceous chondrites. The clean sterile environment on the ice assures that they will have a minimal chance to acquire terrestrial organic contamination. In the case of C2 chondrites this has been demonstrated by the amino acid analysis of interior and exterior pieces of Antarctic meteorite ALHA77306 by CRONIN *et al.* (1979). The amino acid concentrations from the two pieces showed no significant differences. This is important because it will allow analysts to utilize all portions of Antarctic carbonaceous chondrite finds and not limit their samples to interior pieces, if the specimens are stored and handled properly.

In addition to these positive results we have also analyzed the C3V Antarctic chondrite ALHA77307 for amino acids using the method described by CRONIN and MOORE (1971). Earlier searches for amino acids in carbonaceous chondrites have shown them to be most abundant in the C2 types. The opportunity to analyze an

Table 1. Amino acid analysis of ALHA77307.

Amino acid	Concentration (n moles per g)
Glycine	1.5
Alanine	0.7
Aspartic acid	0.4
Glutamic acid	0.9
Valine	0.2

Antarctic C3V chondrite was taken because of its clean pristine nature. As can be seen in Table 1, only low concentrations of the common protein amino acids were seen. The most abundant amino acid, glycine, was present at less than 10 per cent of the concentration found in the C2 chondrite, ALHA77306 (CRONIN *et al.*, 1979). Amino acids that are uniquely characteristic of carbonaceous chondrites were not detected. The results are reminiscent of those obtained with Mokoia, a C3V chondrite (CRONIN and MOORE, 1976). Further studies will be required to establish whether amino acids are indigenous to ALHA77307.

*Table 2. Element abundances in Antarctic chondrites.**

	ALHA77306,8 (22.0 mg) Exterior	ALHA77306,16 (19.0 mg) Interior	ALHA77307,16 (28.8 mg)
TiO_2 (%)	<0.2	<0.2	<0.2
Al_2O_3	2.1	2.1	2.7
FeO	25.4	25.6	30.7
MgO	18.3	18.5	21.0
CaO	1.9	1.8	2.2
Na_2O	0.521	0.564	0.153
K_2O	0.045	0.038	0.029
MnO	0.211	0.208	0.188
Cr_2O_3	0.378	0.386	0.472
Sc (ppm)	7.5	7.4	9.4
V	63	66	80
Co	541	520	508
Ni	10580	10930	9930
La	0.32	0.34	0.37
Sm	0.21	0.21	0.26
Yb	0.20	0.20	0.27
Lu	0.031	0.027	0.034
Au (ppb)	114	126	128
Ir	609	551	646

* Estimated errors due to counting statistics are: Al_2O_3, FeO, Na_2O, MnO, Cr_2O_3, Sc, Co, Ni, Sm, Au and Ir, ±1–5%; MgO ±5–10%; CaO, K_2O, V, La, Yb and Lu, ±10–20%.

Equally important with organic analyses are inorganic studies, particularly of trace elements. Table 2 gives the elemental abundances of the Antarctic carbonaceous chondrites ALHA77306 and ALHA77307. The interior and exterior pieces of ALHA77306 again show no significant differences. The ALHA77306 samples are typical of C2 chondrites except the FeO, Au and Ni seem somewhat lower than in most C2 chondrites. ALHA77306 is similar to Nogoya in its amino acids and also similar in its mineralogy by having most of its chondrules altered to serpentine minerals.

The C2 chondrites do show variations in structure and chemistry therefore such differences are to be expected. The ALHA77307 C3V chondrite likewise shows variations from average C3 chondrites in FeO, MgO and Na_2O as well as Au and Ni. It appears these variations are real based upon comparisons of the two separate samples analyzed for ALHA77306.

Before the report of the Japanese Antarctic Meteorite Search in the 1979–80 season only ten carbonaceous chondrites were reported but the 1979–80 expedition recovered over 20 new pieces of carbonaceous chondrites with a majority being of the C2 type (YANAI *et al.*, 1981). The results of the analysis of the carbonaceous chondrites reported above together with other investigations of Antarctic carbonaceous chondrites by BRECHER (1980), CLAYTON *et al.* (1979), GIBSON and ANDRAWES (1980), HOLZER and ORO (1979), HYMAN and ROWE (1979), JOCHUM *et al.* (1980), KOTRA *et al.* (1979), MARVIN and MOTYLEWSKI (1980), MCKEE and MOORE (1980), MCSWEEN (1979), NAGATA (1980) and two papers by SHIMOYAMA *et al.* in 1979 indicate that these interesting meteorites are falling and being preserved in Antarctica. Equally important studies should be made of the other Antarctic carbonaceous chondrites.

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